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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference BP 9700	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/01637	International filing date (day/month/year) 16.04.2003	Priority date (day/month/year) 17.04.2002
International Patent Classification (IPC) or both national classification and IPC C10G29/20		
Applicant BP CORPORATION NORTH AMERICA INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.  
☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application

Date of submission of the demand 24.10.2003	Date of completion of this report 27.07.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Gilliquet, J-N Telephone No. +31 70 340-4573 

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB 03/01637

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-12 as originally filed

**Claims, Numbers**

1-14 received on 27.04.2004 with letter of 22.04.2004

**Drawings, Sheets**

1-3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-14
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-14
Industrial applicability (IA)	Yes: Claims	1-14
	No: Claims	

2. Citations and explanations

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following document:

D1: US-A-5 171 916 (LE QUANG N ET AL) 15 December 1992 (1992-12-15)

**1. Inventive step**

1.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of independent claims 1 and 2 does not involve an inventive step in the sense of Article 33(3) PCT.

1.2 The document D1 is regarded as being the closest prior art to the subject-matter of present independent claims 1 and 2, and discloses a process for increasing the boiling point of organic nitrogen species present within a light cycle oil by contacting it with an alkylating agent and with an acidic catalyst under alkylation conditions and removing the organic nitrogen species of higher boiling point to generate a liquid hydrocarbon feed with a reduced nitrogen content (See claim 1 of D1).

1.3 The subject-matter of present independent claims 1 and 2 therefore differs from this known process in that the feed envisaged are catalytically cracked naphtha, coker naphtha and visbroken naphtha with comprises olefins (the alkylating agent), so that it is not necessary to add the agent to these feeds.

1.4 The problem to be solved by the present invention may therefore be regarded as how to increase the boiling point of organic nitrogen species in catalytically cracked naphtha, coker naphtha and visbroken naphtha without adding an alkylating agent.

1.5 The skilled person would regard it a normal design procedure not to add an alkylating agent to these feeds that already comprises it.

1.6 Therefore the solution proposed in claims 1 and 2 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT).

**2. Dependent claims**

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2.1 The subject-matter of dependent claims 3, 7, 8 and 10-13 is disclosed in documents D1, so that it can not be considered as involving an inventive step and does not satisfy therefore the criterion set forth in Article 33(3) PCT, for example:

2.1.1 Col.2 §5 of D1 in view of present dependent claims 7 and 10

2.1.2 Col.2 §6 of D1 in view of present dependent claims 8 and 11.

2.2 The features claimed in dependent claims 4-6, 9 and 14 are standard option offered to the skilled person in the art to adapt his process of producing hydrocarbons. Moreover, from the text of the description of the present application, their subject-matter does not contribute to solving the technical problem posed in the application. Therefore it does not involve an inventive step in the sense of Article 33(3) PCT.

3. Clarity

3.1 Although claims 1 and 2 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

3.2 Hence, claims 1 and 2 do not meet the requirements of Article 6 PCT.

## Claims

1. A process for increasing the boiling point of organic nitrogen species present within a liquid hydrocarbon feed wherein said process comprises contacting a liquid hydrocarbon feed comprising organic nitrogen species with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising  
5 organic nitrogen species of higher boiling point.
2. A process for reducing the nitrogen content of a liquid hydrocarbon feed wherein said process comprises
  - a) contacting a liquid hydrocarbon feed comprising organic nitrogen species with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid  
10 hydrocarbon feed comprising organic nitrogen species of higher boiling point
  - b) removing the organic nitrogen species of higher boiling point to generate a liquid hydrocarbon feed comprising a reduced nitrogen content.
3. A process according to claim 2 wherein said process comprises
  - a) contacting a liquid hydrocarbon feed comprising an alkylating agent and organic  
15 nitrogen species with an acidic catalyst at elevated temperature in a first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and organic nitrogen species of higher boiling point.
  - b) removing the organic nitrogen species of higher boiling point to generate a liquid  
20 hydrocarbon feed comprising a reduced alkylating agent content and a reduced nitrogen content.
4. A process according to claims 2 or 3 wherein the organic nitrogen species of higher boiling point is removed by fractionation.

5. A process for reducing the sulphur and nitrogen content of a liquid hydrocarbon feed wherein said process comprises

a) contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen and organic sulphur species with an acidic catalyst at elevated temperature in a

5 first reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and organic nitrogen species of higher boiling point

b) contacting the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and organic nitrogen species of higher boiling point

10 with an acidic catalyst at elevated temperature in a second reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species of higher boiling point and organic nitrogen species of higher boiling point

c) fractionating the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species of higher boiling point and organic nitrogen species of

15 higher boiling point to remove the organic nitrogen species of higher boiling point and the organic sulphur species of higher boiling point to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and a reduced nitrogen and sulphur content.

6. A process for reducing the sulphur and nitrogen content of a liquid hydrocarbon

20 feed wherein said process comprises

a) contacting a liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen and sulphur species with an acidic catalyst at elevated temperature in a first

reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and organic nitrogen species of higher boiling

25 point

b) fractionating the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and organic nitrogen species of higher boiling point to

remove the organic nitrogen species of higher boiling point to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur

30 species and a reduced nitrogen content.

c) contacting the liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species and a reduced nitrogen content with an acidic catalyst at

elevated temperature in a second reaction zone to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content, organic sulphur species of higher boiling point and reduced nitrogen content

d) fractionating the liquid hydrocarbon feed comprising a reduced alkylating agent

5 content, organic sulphur species of higher boiling point and a reduced nitrogen content to remove the organic sulphur species of higher boiling point to generate a liquid hydrocarbon feed comprising a reduced alkylating agent content and a reduced nitrogen and sulphur content.

10 7. A process according to anyone of the preceding claims wherein the liquid hydrocarbon feed is derived from a crude oil distillation.

8. A process according to claim 7 wherein the liquid hydrocarbon feed is selected from diesel, gasoline, kerosene or jet fuel.

9. A process according to anyone of the preceding claims wherein organic nitrogen species is selected from alkyl amines, anilines, pyroles and/or pyridines.

15 10. A process according to anyone of the preceding claims wherein the liquid hydrocarbon feed comprising organic nitrogen species usually has a total nitrogen content (expressed as elemental N) of between 5-3000ppm N

11. A process according to anyone of the preceding claims wherein the organic nitrogen species have a boiling point of between 50 and 450°C.

20 12. A process according to claims 5-11 wherein the organic sulphur species is selected from mercaptans, thiophenes and benzothiophene, dibenzothiophenes and/or hindered alkyl substituted dibenzothiophenes.

25 13. A process according to claims 5-12 wherein the liquid hydrocarbon feed comprising an alkylating agent and organic nitrogen and sulphur species has a total sulphur content (expressed as elemental S) of 10-50000ppm S.

14. A process according to anyone of the preceding claims 3-13 wherein the alkylating agent is an alcohol and/or an olefin.

15. A process according to claim 14 wherein the alkylating agent contains between 3-20 carbon atoms.

30 16. A process according to anyone of claims 3-15 wherein claim the liquid hydrocarbon feed contains at least 1% by weight of alkylating agent.

17. A process according to anyone of the preceding claims wherein the acidic



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catalyst is a solid.

18. A process according to anyone of claims 2-17 wherein the first reaction zone is maintained at a temperature of between 50°C-300°C and at pressure of between 1-100 bar.

5 19. A process according to claims 5-18 wherein the second reaction zone is maintained at a temperature of between 100°C-300°C and at pressure of between 1-100 bar.

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